Uneducated Theory Systems Theory Handbook

Core Principles (Sections 1.1–1.9)

Draft Document — v1.0

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23 March 2026

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Preface (Draft)

This document is an early draft of the core principles underlying the Luke Systems Theory framework. It is intended for archival, review, and iterative refinement. All content is provisional and subject to revision as the theory develops.

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1 The Lag-Structure Principle (LSH)

Any system that processes information through sequential transformations (e.g., perception → interpretation → decision → action) exhibits **lag**: the delay or impedance between stages.

Lag includes:

- time delay
- missing information
- bottlenecks
- cognitive load
- bandwidth limits
- misalignment
- architectural constraints

Lag is not noise; it is a structural property of information flow. System quality depends on how lag is organised.

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2 Threshold Behaviour

As lag accumulates, systems approach **critical thresholds** where behaviour changes qualitatively.

- Below threshold: stable
- At threshold: unstable
- Beyond threshold: collapse

Examples include kitchen meltdowns, traffic gridlock, LLM hallucination loops, cognitive overwhelm, and market flash crashes.

3 Density and Impedance

Density is the amount of information or load packed into a processing window. **Impedance** is anything that slows or distorts information flow.

High density increases lag. Low density reduces lag but reduces function. Systems operate best when density and lag are balanced.

4 Recursive State and Feedback Loops

Systems update recursively:

$$\text{State}_{t+1} = f(\text{State}_t, \text{Input}, \text{Lag})$$

Outputs become inputs. Lag compounds. Feedback loops amplify or dampen behaviour. This explains drift, stabilisation, and collapse.

5 Alignment and Misalignment

Alignment occurs when behaviour matches goals, constraints, and context. Misalignment occurs when behaviour diverges due to distorted interpretation or excessive lag.

Misalignment is not moral failure; it is structural failure.

6 The Goldilocks Zone (Optimal Lag Gradient, L_{opt})

Zero lag is not ideal; it is catastrophic. Every system has an **Optimal Lag Gradient** L_{opt} determined by its constraints.

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System quality:

$$Q \propto \frac{1}{|L - L_{\text{opt}}|}$$

Three regimes:

Sub-Critical ($L > L_{\text{opt}}$)

Too much lag → stagnation, low density, "ghost-like" behaviour.

Goldilocks ($L \approx L_{\text{opt}}$)

Optimal lag → coherence, stability, high performance.

Super-Critical ($L < L_{\text{opt}}$)

Too little lag → oscillation, collapse, runaway feedback.

This resolves the Zero-Lag Paradox.

7 The Discovery Gradient

A system's L_{opt} is fixed by its physical, cognitive, or architectural constraints.

Discovery Lag is the time it takes a system to locate and stabilise around its optimal lag.

Examples include:

- chefs learning a kitchen
- drivers learning a junction
- humans learning emotional regulation
- LLMs learning decoding constraints
- galaxies settling into rotation curves

8 Information Weight

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Information has a processing cost. This cost behaves like **weight**.

- Zero information → zero lag → zero function
- Optimal information → optimal lag → peak performance
- Excess information → excess lag → collapse

Information weight is **relative to the system carrying it**. This explains kitchen flow vs meltdown, LLM coherence vs hallucination, traffic flow vs gridlock, and cognitive clarity vs overload.

9 The Capacity Vector C

Information weight only matters relative to **capacity**. Capacity is multidimensional:

$$\mathbf{C} = (C_{\text{physical}}, C_{\text{cognitive}}, C_{\text{temporal}}, C_{\text{energy}}, C_{\text{bandwidth}}, \ldots)$$

Effective information weight:

$$W_{\text{eff}} = \frac{I}{\mathbf{C}}$$

System quality:

$$Q \propto \frac{1}{\left| \frac{I}{\mathbf{C}} - L_{\text{opt}} \right|}$$

Collapse occurs when any component of the capacity vector is exceeded. This makes the model realistic, predictive, and measurable.

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